3.1 GOES-R user readiness issues: recommendations from the Third GOES-R Users' Conference

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1. INTRODUCTION

The Third GOES-R Users' Conference, focusing on the GOES (Geostationary Operational Environmental Satellite)-R Series was held in Broomfield, Colorado, from May 10 to 13, 2004, with approximately 340 participants from government, the private sector, academia and the international community. The National Oceanic and Atmospheric Administration (NOAA) organized it with the cooperation of the National Aeronautics and Space Administration (NASA), the American Meteorological Society (AMS), the National Weather Association, the World Meteorological Organization, the Marine Technology Society, and the National Institute of Standards and Technology.

The goals of the conference were: (1) to inform GOES users on the status of plans for the GOES-R constellation, instruments and operations; (2) to refine potential user applications for data and products from the GOES-R series; (3) to seek ways to help the user communities prepare for GOES-R; (4) to address user and societal benefits of the GOES-R series as an integral part of the Global Observing System; and (5) to continue to improve communication between NOAA and the GOES User communities. The primary focus of the conference was to explore the steps needed to ensure user readiness for the GOES-R Series.

The conference participants strongly supported the concept of NOAA's Satellite and Information Service starting now to ensure user readiness. Steps to user readiness include: 1) coordinating with all the other NOAA line offices, and the NOAA Mission Goal Teams to ensure that budgets are developed to acquire the needed infrastructure, including communications, hardware and software for user interfaces; 2) leading studies to determine the optimal ways to distribute data and products or make them accessible to the user communities; 3) leading the development and validation of GOES-R products and algorithms, including automated decision support algorithms; 4) leading the development of a comprehensive risk reduction plan, including the use of test-beds or proving grounds at National Weather Service Forecast Offices, modelled after the proving ground concept leading to the deployment of NEXRAD; and 5) developing a comprehensive education and training program to ensure that the entire user community knows how to use the new and improved data and products from GOES-R.

This paper will cover the highlights from the Third GOES-R Users' Conference, focusing on user recommendations and themes from the breakout sessions on the final day of the conference. Some of the themes were: managing the increase in data volume, systems integration, expanding user input opportunities, serving varied user needs, visibility of the program, and quality verification methods. The breakout discussion groups were divided along the lines of common interests, including weather applications; climate applications; coastal and ocean applications; safe and efficient transportation and space weather; hydrological applications; and air quality/fires.

2. RECOMMENDATIONS FROM BREAKOUT GROUPS

The last day of the conference featured breakout sessions. NOAA/NESDIS regards the input from these breakout groups as the most important information from the conference. Participants

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selected the session they wished to attend, and the groups provided recommendations to NOAA. A facilitator and co-technical leads served each group. The sessions were: (1) weather applications; (2) climate applications; (3) safe and efficient transportation; (4) hydrological applications; and (5) air quality/ fires. Participants in each of the breakout groups were asked the following questions: (1) Please discuss your needs for data and product distribution, archiving and access, for example, timeliness, metadata, etc. (2) When should training begin for the user communities? What methods of training should be used? What kind of general education will be needed? What early training and outreach do you foresee? (3) How can NOAA/NESDIS help your organization prepare for GOES-R? (4) NOAA is considering future risk reduction at one or more of its offices to provide a "proving ground" or test bed for prototype operations to ensure that new algorithms, products, and services are validated prior to integrating into official NOAA operations. This approach is patterned after NOAA's NWS Modernization risk reduction operations used earlier to validate and perfect technologies and future services prior to integrating into official operations. (5) Please provide suggestions on items to be included in a user readiness timeline. Following are recommendations on the 5 topics listed above.

3. DATA AND PRODUCT DISTRIBUTION

Users recommended that data, including raw data for reprocessing, and derived products be easily accessible, free and easily processed through a user-friendly interface, in real time. Users need on-demand access to metadata and archived data, including current algorithms. Metadata must include geospatial information, acquisition time, information on product accuracy and stability, information on sensors, and collection platforms, and algorithms used to produce the products. NOAA must consider that users have a wide variety of needs, and wide variety of capabilities to process large amounts of satellite data. While some users may need all the information from GOES-R, they do not necessarily need all the data. Participants also recommended thinking beyond just the traditional rebroadcast (directly from the satellite) for GOES-R. The GOES-R Rebroadcast should be one component of the solution for data and product distribution. The solution set for distribution methods should allow for future advances in communication technology. NOAA should also balance U.S. needs with international user needs, removing any unnecessary delays in data availability to international users. Users also stressed the need for a seamless transition from the GOES N-P series to the GOES-R series, and for rapid access to "thumbnails" of available products across all systems and platforms. Finally, the latest plans for data and product distribution should be made available on the web to allow for continued user inputs.

4. EDUCATION AND TRAINING NEEDS

The primary goal for training should be to ensure that all data are used fully and quickly following the first launch in the GOES-R series. The common theme among users is that training and education should begin early, with the major arenas being schools, universities, workshops, conferences, and on-line. In addition to addressing both the end users' and the developers' needs, training should address how products complement each other as well as provide applicability to real world problems. There are a wide variety of types of users with varying needs. Training must be tailored to meet the unique needs of each user community. Some specific groups cited with unique needs include: NWS forecasters; FAA meteorologists; coastal service centers; air quality modelers; climatologists; broadcast meteorologists; university faculty; researchers; industry users, including value added companies and instrument builders; international community (in coordination with the WMO); middle and upper level NOAA management; K-12 students; and the general public. The proving ground concept that was successful in paving the way for the WSR-88D radar in the NWS should be employed for GOES-R. This will mean stationing extra personnel at selected NWS forecast offices or national centers, and NOS coastal service centers to develop and test high spectral resolution prototype GOES-R products generated from research and operational satellites. COMET should be used to provide education for the professional meteorologists and oceanographers. We should also learn from what EUMETSAT has accomplished in online documentation for image interpretation. Topics for education and training should include: strengths and limitations of the products; new capabilities and algorithms; and both quantitative and qualitative uses of the products.

5. NOAA/ NESDIS GOES-R PREPARATION

In response to the question of how NOAA can help the user communities prepare for GOES-R, the common theme among respondents is that NOAA should maintain two-way communication with the users and developers, both with the big picture and the details, and include a mechanism for users to review feedback. NOAA should provide thorough and up-to-date GOES-R references on the Internet in one location, informing users both within and outside of NOAA of updated plans for instruments and products, including information on the value of the products to the user communities. There should also be a feedback loop from customers on the web site. Conferences and workshops also provide valuable opportunities for information exchanges, including updated information on requirements, GOES-R status, product and algorithm development, and risk reduction activities. Experts from NOAA should also be available to brief other agencies on GOES-R plans. For climate applications, users suggested the development of a climate and education outreach program, including international involvement.

6. RISK REDUCTION

Users provided a great many ideas to support risk reduction activities. Among them were: show the comparisons of products/data between the current GOES and future GOES-R series; provide test datasets in advance; leverage NPP synergy and experiences for GOES-R preparation; and most importantly, develop and validate the products.

To prepare optimal processing of GOES-R data, users felt that NOAA/NESDIS should form expert teams (or science teams) for each core sensor and involve the end user at the local level, both within and outside the government. Users also recommended that sufficient data reduction be packaged to support different operational user classes. NOAA/NESDIS ought to take advantage of existing organizations like Joint Center for Satellite Data Assimilation and establish a focused coastal and ocean user group. Simulated data should be provided to test and validate data processing and distribution systems i.e. data storage and data rates. Users recommended organization of a "coordinated field campaign" as necessary to obtain "in-situ" measurements to exercise "validation processes" and algorithm research panels, and to insure user involvement with scenario-based appreciation (e.g.; fire fighting, storm surge and precipitation-caused flooding). Users stated that the GOES-R system should be tested end-to-end before launch. NOAA/NESDIS should provide sufficient time of overlap and length of time for planning, development, operational integration, and add a timeline for development and integration of algorithms and products, and realistic prototype operations. Algorithm research and development activities must be conducted at "sensor formulation phase" and at sufficient level.

7. CLIMATE ISSUES

The climate users stressed the importance of onboard calibration as well as cross sensor and cross satellite calibration. Instruments must be calibrated pre-launch, post launch and re-calibrated following long periods as an in orbit spare. NOAA/NESDIS should organize workshops in conjunction with the recently formed NOAA calibration working-group to engage the scientific community, both domestic and international to ensure that scientific requirements are being met, and that long-term stability requirements are met. The climate breakout group also expressed concern about the operational plans for the HES. If the HES is used frequently in the Mesoscale sounding mode, there may not be enough time for full disk soundings to properly characterize the diurnal cycle for climate monitoring.

Users were asked about their needs for data product and distribution, and archiving and access. They responded that they wanted access to the original data for reprocessing as well as all instrument and performance monitoring data, including any knowledge of stability, uncertainty, and errors within the measurements. The users would like to have the data in a friendly format that can be accessed with commercial off-the-shelf software that requires minimal additional processing, while still having access to raw data for their reprocessing needs. They believe the Climate Data Records (CDRs) should be generated using a separate CDR system, as recommended by the Academy Study. Ideally, the archiving and access of data, including metadata, should be easily accessible with multispectral imagery of specific events and locations on demand. The formation of focus groups can assist in the further refinement of environmental archiving, reprocessing, and metadata needs. The existing training programs such as Comet and Vista should be expanded to include climate modules. The Climate community should be educated and trained to use GOES-R climate

products and to complement other satellite and "in situ" derived climate products.

To reduce future risk, the users recommended: begin production of near real-time CDRs to monitor the current state of the climate system and any short term variations; plan for reprocessing, archiving, and distribution of CDRs to create long-term records that are a consistent, seamless, high quality time-series with minimized bias; and lastly, establish a test bed for all components of the end-to-end GOES system, acquisition to archive.

8. SUMMARY

The Third GOES-R Users' Conference, focusing on the GOES (Geostationary Operational Environmental Satellite)-R Series was held in Broomfield, Colorado, from May 10 to 13, 2004. There were approximately 340 total participants from government, the private sector, academia and the international community. The conference successfully met its many goals. The next conference is tentatively slated for May of 2006.

9. REFERENCES

GOES-R User Conference Report. 1st GOES Users' Conference May 22-24, 2001, NOAA/NESDIS, Boulder CO.

GOES-R User Conference Report. 2nd GOES Users' Conference October 1-3, 2002, NOAA/NESDIS, Boulder CO.

GOES-R User Conference web site can be found at: http://www.osd.noaa.gov/announcement